#10/ Appeal Brief
6-9-03
V. Short

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Patent Application of:

Sambasivam, et al.

Serial No.: 10/033,854

Filed: December 19, 2001

For: UNDERFILL MATERIALS DISPENSED IN A FLIP CHIP PACKAGE BY WAY OF A THROUGH HOLE

Attorney Docket No.: 42390.P13267

Art Unit: 2823

Examiner: K. Nguyen

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

APPEAL BRIEF
IN SUPPORT OF APPELLANTS' APPEAL
TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Sir:

Applicants (hereafter "Appellants") hereby submit this Brief in triplicate in support of his Appeal from a final decision by the Examiner in the above-captioned case. Appellants respectfully requests consideration of this Appeal by the Board of Patent Appeals and Interferences for allowance of the claims in the above-captioned patent application.

An oral hearing is not desired.

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The invention is assigned to Intel Corporation of 2200 Mission College Boulevard, Santa Clara, California 95052.

II. RELATED APPEALS AND INTERFERENCES

To the best of Appellants' knowledge, there are no appeals or interferences related to the present appeal, which will directly affect, be directly affected by, or have a bearing on the Board's decision.

III. STATUS OF THE CLAIMS

Claims 1-20 are the subject of the present appeal.

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Applicants' Admitted Prior Art (hereinafter "the AAPA") in combination with U.S. Patent No. 5,590,462 issued January 7, 1997 to Michael Hundt and Carlo Cognetti (hereinafter "the Hundt patent") and U.S. Patent No. 6,242,798 issued June 5, 2001 to Gi-Bon Cha and Byeong-Duck Lee (hereinafter "the Cha patent").

IV. STATUS OF AMENDMENTS

In response to the Final Office Action mailed on December 3, 2002 and the Advisory Action mailed on February 27, 2003, Appellants timely filed a Notice of Appeal on March 27, 2003. The claims have not been amended.

A copy of all claims on appeal, claims 1-20, is attached hereto as Appendix A.

IV. SUMMARY OF THE INVENTION

The present invention relates to methods for dispensing underfill materials during microelectronic package fabrication and the microelectronic packages resulting from the same. In particular, the present invention relates to injecting an underfill material through a hole in a substrate that supports a flip chip within the microelectronic package. Background of the Invention, page 2, lines 5-9.

In the field of electronic systems, there is continuous competitive pressure to increase the performance of components while reducing production costs. This competitive pressure is particularly intense in the fabrication of microelectronic devices, where each new generation

must provide increased performance while also reducing the size or footprint of the microelectronic device. Background of the Invention, page 2, lines 10-14.

As shown in FIG. 12, an exemplary microelectronic packag includes a microelectronic die 202 that is mounted on a substrate 204, which functionally connects the microelectronic die 202 through a hierarchy of electrically conductive paths (not shown) to the other electronic components (not shown). The illustrated method for electronically mounting the microelectronic die 202 to the substrate 204 is called flip chip bonding. This includes solder bumps or balls (leaded and unleaded), stud bump, and polymer bump interconnection. In this mounting method, electrically conductive terminals or pads 206 on an active surface 208 of the microelectronic die 202 are attached directly to corresponding lands 212 on a surface 214 of the substrate 204 using reflowable solder bumps or balls 216 (shown), thermocompression bonding, or any other known methods of flip chip attachment. Background of the Invention, page 2, line 15 through page 3, line 2.

To enhance the reliability of the solder bumps 216 connecting the microelectronic die pads 206 and the substrate lands 212, an underfill material is used to mechanically and physically reinforce them. In a known method of underfill encapsulation shown in FIGs. 13 and 14, a low viscosity underfill material 222, such as an epoxy material, is dispensed from at least one dispensing needle 230 along at least one edge 224 (usually one or two edges) of the microelectronic die 202. The underfill material 222 is drawn between the microelectronic die 202 and the substrate 204 by capillary action (in generally the x-direction shown as arrows 240 in FIG. 14), and the underfill material 222 is subsequently cured (hardened) using heat, which forms the microelectronic package 200 shown in FIG. 15. Background of the Invention, page 3, lines 3-11.

With the pressure to decrease the size of the microelectronic packages, bump pitch 226 and bump height 228 has decreased. Thus, it has become successively more difficult to obtain adequate underfill material dispersion without continuously deceasing the viscosity of the underfill material 222 or improving its wettability properties. However, decreasing the viscosity and/or improving the wettability of the underfill material 222 results in the underfill material 222 bleeding out and substantially surrounding the microelectronic die 202, as shown in FIG. 15 and 16. This bleedout area beyond the edges 224 of the microelectronic die 202 is generally referred to as the "underfill tongue" 232. The underfill tongue 232 is a problem because it covers and contaminates valuable surface area on the substrate 204. Background of the Invention, page 3, lines 12-22.

For example, as shown in FIG. 17, an exemplary stacked package 250 includes a microelectronic die 202 that is mounted on a substrate 204 with a plurality of solder bumps 216 extending between microelectronic die pads 206 and substrate lands 212, as discussed with regard to FIG. 12. A second microelectronic die 242 is attached by its back surface 244 to a back surface 246 of the microelectronic die 202 with a layer of adhesive 248. A plurality of wirebonds 252 makes electrical contact between lands 254 on an active surface 256 of the second microelectronic die 242 and wirebond lands 258 on the substrate 204. The substrate wirebond lands 258 are placed as close to the microelectronic die 202 as possible in order to conserve the valuable surface area in the substrate 204 and also meet chip scale package small form factor requirements. However, FIG. 17 illustrates the stacked package 250 without an underfill material. As shown in FIG. 18, the underfill material 222 is disposed before the wirebonds 252 (see FIG. 17) are attached. However, the underfill tongue 232 extends 2-5 mm wide 234, which covers the wirebond lands 258. Thus, at least the portion of the underfill tongue 232 covering the wirebond lands 258 would have to be removed in order to attach the wirebonds 252 (see FIG. 17). This, of course, is difficult and may reduce the reliability of the microelectronic device, as well as increasing the package cost. Background of the Invention, page 1, lines 1-17.

Although techniques such molding processes have been tried with limited success, there is currently no reasonable solution to the underfill tongue problem. The present invention presents an apparatus and techniques to effectively dispose underfill material between a microelectronic die and the substrate while substantially reducing the underfill tongue. FIGs. 1-7 illustrate a method of forming an exemplary microelectronic device. FIG. 1 illustrates a substrate 102, such as a motherboard, interposer, or the like, including a plurality of lands 104 disposed on a first surface 106 thereof. The substrate lands 104 are connected to a hierarchy of electrical conductive paths (not shown) to other electronic components (not shown) to provide electrical connection thereto with a subsequently mounted microelectronic die. As shown in FIG. 2, a through-hole 108 is formed through the substrate 102 extending from the substrate first 106 to an opposing second surface 110. A via or through-hole 108 may be formed by any method known in the art, including, but not limited to drilling, laser ablation, etching, and the like. Detailed Description, page 7, line 19 through page 8, line13.

As shown in FIG. 3, a microelectronic die 112 is electronically mounted on the substrate 102. The illustrated method for electronically mounting the microelectronic die 112 to the substrate 102 is the attachment methods previously discussed. Electrically conductive

terminals or lands 116 on an active surface 118 of the microelectronic die 112 are attached directly to the corresponding substrate lands 104 using conductive bumps or balls 114. The resulting structure is then flipped, as shown in FIG. 4, to expose the through-hol 108 from the substrate second surface 110. This flipping of the structure places the structure in an orientation such that the microelectronic die 112 is gravitationally below the substrate 102. In other word, gravity pulls toward the microelectronic die 112 relative to the substrate 102. An underfill dispensing tool 122, such as a dispense needle, is positioned in or proximate to the through-hole 108 and an underfill material 124 is dispensed through the underfill dispensing tool 122 and into the through-hole 108, as shown in FIG. 5. Detailed Description, page 8, line 14 and page 9, line 5.

As shown in FIG. 6, capillary action distributes the underfill material 124 substantially evenly in all directions (illustrated by arrows 120) during injection. As further shown in FIG. 5, the underfill material 124 flows around the conductive bumps 114 and forms a fillet 126 proximate edges 128 of the microelectronic die 112. The combination of the gravity pulling the underfill material 124 toward the microelectronic die 112 and the inherent surface tension of the underfill material 124 will restrict the flow of the underfill material 124 proximate the microelectronic die edges 128. Thus, this process substantially reduces underfill tongue. It is, of course, understood that the through-hole 108 should be positioned in relation to the pattern of the conductive balls 114 such that the underfill material 124 distributes itself substantially evenly. Furthermore, it is preferred that a predetermined amount of underfill material 124 be used, as an excess amount may overcome the surface tension at the fillet 126, causing the underfill material 124 to drip. Detailed Description, page 9, lines 9-20.

The underfill dispensing tool 122 is withdrawn and the underfill material 124 is then cured (usually heated to solidify the underfill material), resulting in the microelectronic package 130, as shown in FIG. 7. It is preferred that the conductive bumps or balls 114 are reflowed for attachment prior to dispensing the underfill material. However, it is understood that the reflow (if necessary) of conductive bumps or balls 114 for the attachment of the microelectronic die 112 would also be achieved simultaneously with the curing of the underfill material 124. Furthermore, although the underfill material 124 is preferably curing while inverted, it may be cured in any position. Detailed Description, page 9, line 21 through page 10, line 5.

Although inverting the resulting structure, as shown in FIG. 4, and performing the fabrication steps of FIGs. 5 and 6, it is not necessary. As shown in FIG. 8, the underfill

dispensing tool 122 may be positioned in or proximate to the through-hole 108 without inversion and the underfill material 124 is dispensed through the underfill dispensing tool 122 and into the through-hole 108. Capillary action distributes the underfill material 124 substantially evenly around the conductive bumps 114 and forms the fillet 126 proximate edges 128 of the microelectronic die 112. Again, it is preferred that a predetermined amount of underfill material 124 be used. Detailed Description, page 10, lines 6-13.

As it will be evident to those skilled in the art, the size of the through-hole 108 is preferably optimized based on a number of variables including, but not limited to, the size of the microelectronic die 112, the underfill material 124 rheology, the size of any filler particles used in the underfill material 124, and the size of the underfill dispensing tool 122. Furthermore, although the through-hole 108 is illustrated as being positioned proximate the position of the center of the microelectronic die 112, its position can be varied or optimized depending on the size and pattern of conductive bumps 114 to optimize the flow pattern of the underfill material 124. Detailed Description, page 10, lines 14-21.

FIGs. 8-10 illustrate the formation of a stacked microelectronic device. FIG. 8 illustrates an intermediate structure 140 comprising a substrate 134 having a through-hole 108 and microelectronic die 112 attached to an active surface 136 thereof, as well as an underfill material 124 disposed between the substrate 134 and the microelectronic die 112 and cured as described in FIGs. 5-7. The substrate 134 also includes at least one wirebond land 132 on an active surface 136 thereof. Detailed Description, page 10, line 22 through page 11, line 4.

FIG. 9 illustrates a second microelectronic die 142 attached by its back surface 146 to a back surface 144 of the microelectronic die 112 with a layer of adhesive 148. As shown in FIG. 10, a plurality of wirebonds 158 makes electrical contact between lands 152 on an active surface 154 of the second microelectronic die 142 and wirebond lands 132 on the substrate 134 to form the stacked microelectronic device 160. Preferably, the underfill material 124 is cured prior to the attachment of the second microelectronic die 142. Furthermore, it is understood that the underfill material 124 may be disposed and cured after the attachment of the second microelectronic die 142. Detailed Description, page 11, lines 5-12.

It is, of course, understood that additional steps and fabrication could be undertaken, including mold/encapsulation of the packages of FIGs. 7 and 10, attachment of heat dissipation devices, and the formation of multi-stack packages. Detailed Description, page 11, lines 13-15.

VI. ISSUES PRESENTED

Whether claims 1-20 are obvious under 35 U.S.C. § 103(a) over the AAPA in combination with the Hundt patent and the Cha patent.

VII. GROUPING OF CLAIMS

For the purposes of this appeal, claims 1-20 stand or fall together.

VIII. ARGUMENT

REJECTION OF CLAIMS 1-20 UNDER 35 U.S.C. § 103(a) OVER THE AAPA IN COMBINATION WITH THE HUNDT PATENT AND THE CHA PATENT IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO COMBINE THE REFERENCE HAS BEEN DEMONSTRATE. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The Examiner has rejected claims 1-20 under 35 U.S.C. § 103(a) as being obvious over the AAPA in combination with the Hundt patent and the Cha patent.

The first independent claim, claim 1, is drawn to a method of fabricating a microelectronic package, comprising providing a substrate having a first surface, an opposing second surface, and a plurality of lands disposed on the first surface, forming a through-hole extending from the substrate first surface to the substrate second surface, providing a microelectronic die having an active surface, a back surface, and a plurality of pads disposed on said active surface in a corresponding relationship to the plurality of substrate lands, electrically attaching the plurality of substrate lands to the plurality of corresponding microelectronic die pads with a plurality of conductive bumps, and disposing an underfill material through the through-hole such that said underfill material is dispersed between the microelectronic die active

surface and the substrate first surface. Claim 2 depends from claim 1 and further includes the additional limitation that forming the through-hole comprises forming the through-hole by at least one of the methods consisting of drilling, laser ablation, and etching. Claim 3 depends from claim 1 and further includes the limitation that disposing the underfill material comprises positioning an underfill material dispensing device proximate the through-hole and injecting the underfill material into the through-hole. Claim 4 depends from claim 1 and further includes the limitation that positioning the underfill material dispensing device proximate the through-hole comprises positioning a dispensing needle proximate the through-hole. Claim 5 depends from claim 1 and further includes the limitation that disposing the underfill material comprises disposing an epoxy material. Claim 6 depends from claim 1 and further includes the limitation of further including curing the underfill material.

The second independent claim, claim 7, is drawn to a method of fabricating a microelectronic package, comprising providing a substrate having a first surface, an opposing second surface, and a plurality of lands disposed on the first surface, forming a through-hole extending from the substrate first surface to the substrate second surface, providing a microelectronic die having an active surface, a back surface, and a plurality of pads disposed on the active surface in a corresponding relationship to the plurality of substrate lands, electrically attaching the plurality of substrate lands to the plurality of corresponding microelectronic die pads with a plurality of conductive bumps, positioning the microelectronic die and the substrate such that the microelectronic die is gravitationally below the substrate; and disposing an underfill material through the through-hole such that the underfill material is dispersed between the microelectronic die active surface and the substrate first surface. Claim 8 depends from claim 7 and includes the additional limitation that forming the through-hole comprises forming the through-hole by at least one of the methods consisting of drilling, laser ablation, and etching. Claim 9 depends from claim 7 and includes the additional limitation that disposing the underfill material comprises positioning an underfill material dispensing device proximate the through-hole and injecting the underfill material into the through-hole. Claim 10 depends from claim 9 and includes the additional limitation that positioning the underfill material dispensing device proximate the through-hole comprises positioning a dispensing needle proximate the through-hole. Claim 11 depends from claim 7 and includes the additional limitation that disposing the underfill material comprises disposing an epoxy material. Claim 12 depends from claim 7 and includes the additional limitation of further including curing the underfill material.

The third independent claim, claim 13, is drawn to a method of fabricating a microelectronic package, comprising providing a substrate having a first surface, an opposing second surface, a plurality of lands disposed on the first surface, and at least one wirebond land on the first surface, forming a through-hole extending from the substrate first surface to the substrate second surface, providing a microelectronic die having an active surface, a back surface, and a plurality of pads disposed on the active surface in a corresponding relationship to the plurality of substrate lands, electrically attaching the plurality of substrate lands to the plurality of corresponding microelectronic die pads with a plurality of conductive bumps, disposing an underfill material through the through-hole such that the underfill material is dispersed between the microelectronic die active surface and the substrate first surface, providing a second microelectronic die having an active surface, a back surface, and at least one wirebond pad disposed on the active surface, attaching the second microelectronic die back surface to the microelectronic die back surface, and attaching at least one wirebond between at least one substrate wirebond land and the second microelectronic die wirebond pad. Claim 14 depends from claim 13 and includes the additional limitation that forming the through-hole comprises forming the through-hole by at least one of the methods consisting of drilling, laser ablation, and etching. Claim 15 depends from claim 13 and includes the additional limitation that disposing the underfill material comprises positioning an underfill material dispensing device proximate the through-hole and injecting the underfill material into the through-hole. Claim 16 depends from claim 15 and includes the additional limitation that positioning the underfill material dispensing device proximate the through-hole comprises positioning a dispensing needle proximate the through-hole. Claim 17 depends from claim 13 and includes the additional limitation that disposing the underfill material comprises disposing an epoxy material. Claim 18 depends from claim 13 and includes the additional limitation of further including curing the underfill material. Claim 19 depends from claim 13 and includes the additional limitation that attaching the second microelectronic die back surface to the microelectronic die back surface comprises disposing a layer of adhesive therebetween. Claim 20 depends from claim 13 and includes the additional limitation of further including positioning the microelectronic die and the substrate such that the microelectronic die is gravitationally below the substrate prior to disposing the underfill material.

As the Office is aware, "hindsight reconstruction" cannot be used to select isolated disclosures in the prior art to arrive at a determination of obviousness. "It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings

of the prior art so that the claimed invention is rendered obvious. The mere fact that the prior art may be modified in the manner suggested by the Examiner does not mak the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992).

The Office Action relies on the AAPA (i.e., the background section of the present application) for a teaching of a flip chip attached to a substrate with an underfill material dispersed therebetween. The Office Action admits that the AAPA fails to disclose forming a through hole extending from the substrate first surface to the substrate second surface and disposing the underfill material through the through hole.

The Hundt patent is relied upon for teaching "a through hole extending from the substrate first surface to the substrate second surface and disposing the underfill (figure 2, 18) through the through hole." However, as stated in Appellants' September 5, 2002 Response, this is an inaccurate statement of the teaching of the Hundt patent. The Hundt patent teaches dispensing a thermally conductive adhesive (not an underfill material) between a substrate and a quad flat pack-type of a microelectronic device through a through hole.

In the December 3, 2003 Final Office Action's "Response to Arguments", the Examiner contended that "the thermally conductive adhesive material as taught by Hundt is an underfill material because the applicant does not specifically disclose what type of material the underfill material comprises." This is an incorrect. As one of ordinary skill in the art knows, the terms "adhesive" and "underfill material" have very distinct definitions. An adhesive material is used to attach one component to another. An underfill material is used with flip-chip arrangements, after the microelectronic die is attached to the substrate with the conductive bumps. Thus, the underfill material is not used for attachment purposes. As one skilled in the art knows, the underfill material is used to distribute and minimize the solder joint strains, thus improving thermal cycling fatigue life. That is precisely what is described in the Background of the present specification at page 2, line 3-5, "To enhance the reliability of the solder bumps 216 connecting the microelectronic die pads 206 and the substrate lands 212, an underfill material is used to mechanically and physically reinforce them." Thus, it is clear the term "underfill material" is not analogous to the adhesive as taught in the Hundt patent.

In Response to the Appellants' comments, the February 27, 2003 Advisory Action attempts to overcome the Appellants' contention. Oddly, rather than overcoming the Appellants' contention, the Examiner has actually reinforced the Appellants' contention. The February 27, 2003 Advisory Action states:

> . . . Hundt discloses a thermally conductive adhesive 24 is injected into the region 16 through hole 18 wherein the adhesive is a good thermal conductor, and helps carry away heat g nerat d by the chip within the package 20, the adhesive also serves the secondary purpose of improving the physical bond between the chip and the printed circuit board 10 (col. 2, lines 40-53 and FIG. 2).

This is simply a definition of a thermally conductive adhesive. The Examiner continues with a

> . . . Thus, the adhesive material as taught by Hundt is an underfill material since it is being filled under the chip . . .

Oddly, the Examiner is contending that location of a substance dictates what the substances is. This makes no more sense than saying that "because water is placed in a gasoline can, it is gasoline". As stated by the Appellants, the term "underfill material" has a specific meaning in the art. Again, as stated by the Appellants in the specification of the present invention and in the December 31, 2003 Response After Final Rejection, underfill materials are used to enhance the reliability of the solder bumps connecting the microelectronic die pads and the substrate lands by mechanically and physically reinforce the solder bumps. The structures of the Hundt patent do not even have solder bumps at all. Because an adhesive is placed "under" a chip to "fill" a gap, does not make the adhesive an "underfill", any more than "wearing" an athletic heart rate monitor "under" your t-shirt, makes the heart rate monitor, a pair of "underwear".

Thus, it is clear that the Hundt patent involves a different field of endeavor in terms of microelectronic devices (quad flat pack versus flip-chip) and materials (adhesive versus underfill material). "In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the invention was concerned." In re Oetiker, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992) (See M.P.E.P. 2141.01(a)). Thus, the Hundt patent is neither in the field of Appellants' endeavor nor reasonably pertinent to the particular problem with which the present invention is concerned.

Furthermore, a teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellants' disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). A showing of a suggestion, teaching, or motivation to combine prior teachings "must be clear and particular." In re Dembiczak, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999). There is simply no teaching or suggestion in the Hundt patent that such adhesive material would be

applicable for use as an underfill material in a flip-chip configuration or that a through hole in the substrate would be an appropriate way to dispense underfill type of materials between a flip-chip and a substrate.

The December 3, 2002 Final Office Action continued with the statement that "[n]either AAPA nor Hundt disclose positioning the microelectronic die and the substrate such that the microelectronic die is gravitationally below the substrate." The Cha patent is relied upon for teaching "the epoxy can be applied from the top down through a through hole instead of injected upward." It was assumed that the Examiner was referring to claims 7-12 and 20, as they are the only claims that contain such a limitation.

Again, "[i]n order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the invention was concerned." In re Oetiker, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992) (See M.P.E.P. 2141.01(a)). The Cha patent involves a different field of endeavor, as it is merely encapsulating a wirebonded chip with an encapsulation material. The Cha patent teaches dispensing an encapsulant material (i.e., epoxy resin) into what is in essence a closed container (see FIG. 4A of the Cha patent). The presently claimed invention is a flip-chip configuration wherein there is a gap around the periphery of the flip-chip microelectronic die, not a "closed container", as shown in the Cha patent. Thus, with such a gap, conventional wisdom would assume that dispensing the underfill material with the microelectronic die gravitationally below the substrate would result in the underfill material running out of the gap and dripping from the microelectronic die. Thus, it should be clear that encapsulating a wirebonded chip in a closed container is a different endeavor from dispensing the underfill material as described in the present invention.

In Response to the Appellants' comments, the February 27, 2003 Advisory Action attempts to overcome the Appellants' contention. Again, oddly, rather than overcoming the Appellants' contention, the Examiner has actually reinforced the Appellants' contention. The Examiner simply states:

> . . . the Cha patent only being used as a secondary to teach positioning the microelectronic die and the substrate such that the microelectronic die is gravitationally below the substrate prior to disposing the underfill material . . .

This statement also makes no logical sense. The Examiner is using the Cha patent for the orientation of the chips without regard to what is actually being done in the Cha patent and

without making any connection of why it would be obvious to one skill in the art to orient the chips in the manner of Cha for encapsulation in a process of dispensing an underfill material.

Furthermore, a teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellants' disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). A showing of a suggestion, teaching, or motivation to combine prior teachings "must be clear and particular." In re Dembiczak, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999). There is simply no teaching or suggestion in the Cha patent that a through hole in the substrate would be an appropriate way to dispense underfill type of materials between a flip-chip and a substrate with the flip-chip below the substrate.

Therefore, it respectfully appears to the Appellants that the Examiner has impermissibly taken isolated, non-analogous art and used the claimed invention as template to piece together the teachings of the prior art so that the claimed invention can be argued to be obvious. It also appears the Examiner did not take into account only knowledge which was within the level of ordinary skill in art at the time the claimed invention was made and includes knowledge gleaned from the Appellants' disclosure, thus the reconstruction is improper. In re McLaughlin, 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971).

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claims 1-20 recites patentable subject matter.

IX. CONCLUSION

Appellants respectfully submit that all the pending claims in this patent application are patentable and request that the Board of Patent Appeals and Interferences overrule the Examiner and direct allowance of the rejected claims.

This brief is submitted in triplicate, along with a check for $320.00 to cover the appeal fee for one other than a small entity as specified in 37 C.F.R. § 1.17(c).

Respectfully submitted,

Date: May 27, 2003

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313 on:

27 May 2003
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Deborah L. Higham
Name of Person Mailing Correspondence

Signature 5/27/03
Date

APPENDIX A: CLAIMS ON APPEAL

1. A method of fabricating a microelectronic package, comprising:

providing a substrate having a first surface, an opposing second surface, and a plurality of lands disposed on said first surface;

forming a through-hole extending from said substrate first surface to said substrate second surface;

providing a microelectronic die having an active surface, a back surface, and a plurality of pads disposed on said active surface in a corresponding relationship to said plurality of substrate lands;

electrically attaching said plurality of substrate lands to said plurality of corresponding microelectronic die pads with a plurality of conductive bumps;

disposing an underfill material through said through-hole such that said underfill material is dispersed between said microelectronic die active surface and said substrate first surface.

2. The method of claim 1, wherein forming said through-hole comprises forming said through-hole by at least one of the methods consisting of drilling, laser ablation, and etching.

3. The method of claim 1, wherein disposing said underfill material comprises positioning an underfill material dispensing device proximate said through-hole and injecting said underfill material into said through-hole.

4. The method of claim 1, wherein positioning said underfill material dispensing device proximate said through-hole comprises positioning a dispensing needle proximate said through-hole.

5. The method of claim 1, wherein disposing said underfill material comprises disposing an epoxy material.

6. The method of claim 1, further including curing said underfill material.

7. A method of fabricating a microelectronic package, comprising:

providing a substrate having a first surface, an opposing second surface, and a plurality of lands disposed on said first surface;

forming a through-hole extending from said substrate first surface to said substrate second surface;

providing a microelectronic die having an active surface, a back surface, and a plurality of pads disposed on said active surface in a corresponding relationship to said plurality of substrate lands;

electrically attaching said plurality of substrate lands to said plurality of corresponding microelectronic die pads with a plurality of conductive bumps;

positioning said microelectronic die and said substrate such that said microelectronic die is gravitationally below said substrate; and

disposing an underfill material through said through-hole such that said underfill material is dispersed between said microelectronic die active surface and said substrate first surface.

8. The method of claim 7, wherein forming said through-hole comprises forming said through-hole by at least one of the methods consisting of drilling, laser ablation, and etching.

9. The method of claim 7, wherein disposing said underfill mat rial comprises positioning an underfill material dispensing device proximate said through-hole and injecting said underfill material into said through-hole.

10. The method of claim 9, wherein positioning said underfill material dispensing device proximate said through-hole comprises positioning a dispensing needle proximate said through-hole.

11. The method of claim 7, wherein disposing said underfill material comprises disposing an epoxy material.

12. The method of claim 7, further including curing said underfill material.

13. A method of fabricating a microelectronic package, comprising:

providing a substrate having a first surface, an opposing second surface, a plurality of lands disposed on said first surface, and at least one wirebond land on said first surface;

forming a through-hole extending from said substrate first surface to said substrate second surface;

providing a microelectronic die having an active surface, a back surface, and a plurality of pads disposed on said active surface in a corresponding relationship to said plurality of substrate lands;

electrically attaching said plurality of substrate lands to said plurality of corresponding microelectronic die pads with a plurality of conductive bumps;

disposing an underfill material through said through-hole such that said underfill material is dispersed between said microelectronic die activ surface and said substrat first surface;

providing a second microelectronic die having an active surface, a back surface, and at least one wirebond pad disposed on said active surface;

attaching said second microelectronic die back surface to said microelectronic die back surface; and

attaching at least one wirebond between said at least one substrate wirebond land and said second microelectronic die wirebond pad.

14. The method of claim 13, wherein forming said through-hole comprises forming said through-hole by at least one of the methods consisting of drilling, laser ablation, and etching.

15. The method of claim 13, wherein disposing said underfill material comprises positioning an underfill material dispensing device proximate said through-hole and injecting said underfill material into said through-hole.

16. The method of claim 15, wherein positioning said underfill material dispensing device proximate said through-hole comprises positioning a dispensing needle proximate said through-hole.

17. The method of claim 13, wherein disposing said underfill material comprises disposing an epoxy material.

18. The method of claim 13, further including curing said underfill material.

19. The method of claim 13, wherein said attaching said second microelectronic die back surface to said microelectronic die back surface comprises disposing a layer of adhesive therebetween.

20. The method of claim 13, wherein further including positioning said microelectronic die and said substrate such that said microelectronic die is gravitationally below said substrate prior to disposing said underfill material.